Capabilities Statement – Datacasting as a Complement to FirstNet

Public television operates a nationwide network of high-power broadcast television stations that cover 97% of the U.S. population, including territories. Datacasting is a technology that enables this existing broadcast infrastructure to deliver encrypted and targetable IP data along with its television programming. The combination allows for a nationwide wireless IP delivery network that is natively multicast, just like the TV signals it rides on.

SpectraRep LLC, a Washington, DC-based technology company, has pioneered datacasting and developed tools and technology to allow public safety communications and can merge LTE and datacasting, creating a new capability that conserves LTE bandwidth by seamlessly moving content destined for multiple recipients onto the more spectrally-efficient multicast path. SpectraRep has also created a content dashboard that allows public safety users to manage content, share and view video with and from other agencies. The SpectraRep technology has been deployed in multiple successful pilots, including projects in Houston and Chicago funded by DHS and vetted by the Johns Hopkins University Applied Physics Laboratory ("JHU/APL").

America's Public Television Stations ("APTS") and its membership, collectively operating approximately 200 stations in all 50 States and the territories and serving nearly all of the American people, has committed in principle to designate 1 Mbps of its channel capacity to provide a nationwide communications network as a component of the FirstNet public safety initiative. It is possible to send high quality video and large files within this allocation. APTS makes this commitment in association with SpectraRep, who has been its partner for public safety communications in a number of markets.

Datacasting has the potential to provide significant benefit to first responders and law enforcement. Potential benefits include the following:

- Broadcast TV signals are widely available in urban, suburban, and rural areas, so datacasting coverage is extensive. Public television covers 97% of the US population, including territories.
- Because datacasting uses existing broadcast television infrastructure, it is highly reliable and resilient. Broadcast television has a proven track record of staying on the air even during severe weather events and extended power outages as demonstrated during Superstorm Sandy.
- Datacasting is not subject to congestion during emergencies. The licensed television spectrum is controlled by the TV station licensee and manned 24/7 by professional engineers. When they allocate bandwidth to public safety, the same quality of service will always be available.
- Datacasting can be used to multicast data to a large number of users for the same cost as the transmission of data to a single user. Datacasting can make more efficient use of available bandwidth and reduce the load on LTE bandwidth, freeing that spectrum up for other uses.
- Datacasting leverages a system designed primarily for the transmission of high quality video and audio streams. Thus, it has the innate ability to address the public safety community's desire for high quality audio and video data transport.

- TV stations are designed as a communications hub, where fiber, satellite, microwave and LTE carrier aggregation allowing for content aggregation from a remote command, state or national government agency and distribution over a local TV station for last mile delivery.
- Datacasting is relatively inexpensive to implement and operate. The bulk of the network operating costs are already covered under a different service model. Incorporating datacasting into a comprehensive communications plan leverages this sunk cost making datacasting very cost effective.

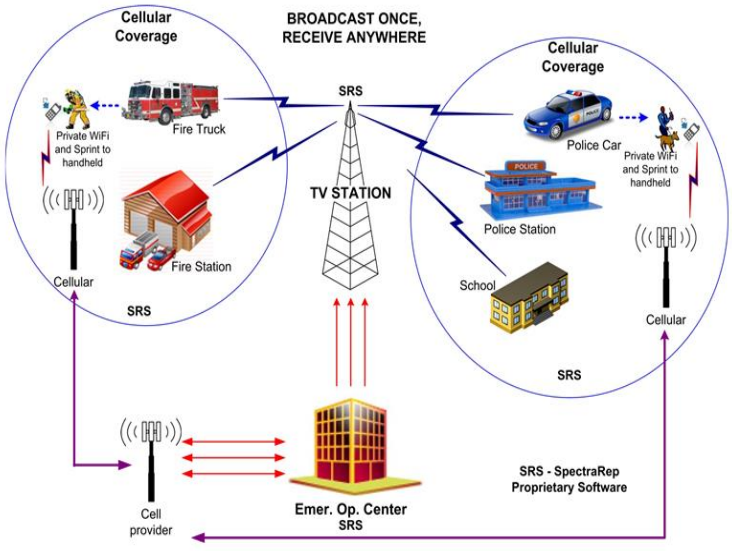
Equally important to these valuable benefits, public television has a consistency of mission with public safety. Both have a primary goal to serve their local communities. A public/private partnership between the public safety community and public television will allow both to better accomplish their mutual goal. Both are motivated to do what is right and provide better service to the public.

Technology Overview

Broadcast television has an eighty-year history of managing and delivering high value content to large numbers of end users. We propose to leverage that expertise, along with SpectraRep's technology and the APTS stations' nationwide broadcast infrastructure, to improve public safety information sharing.

Datacasting is a technology that utilizes a dedicated portion of broadcast television bandwidth to provide secure, targeted IP data delivery, including files, messages, images, alerts and video. Public television stations will partner with public safety and provide this bandwidth full-time. Data is encoded, encrypted, registered (for access control), and multiplexed with other program streams into the digital television broadcast signal. It will only be receivable on targeted computer devices and will be undetectable on television viewed by the public. Because it uses the resilient TV station infrastructure, datacasting is highly reliable, especially during emergencies.

Broadcast television operates on 6 MHz channels. The current Advanced Television Systems Committee (ATSC) digital television standard enables each channel to deliver just under 20Mbps (19.392658 Mbps) of MPEG transport packets. This capacity will be increasing to more than 30 Mbps with the new ATSC 3.0 standard that will be adopted prior to the FirstNet rollout. The new standard will improve bit density, mobility, bandwidth efficiency and add many other enhancements. It will also support reception on handheld devices directly off-air anywhere the TV signal can be received.



Unlike traditional TV content, all datacast content is encrypted with AES-256 encryption and can be targeted to individuals, or groups of users. Like traditional TV content, the TV broadcasts also allow unlimited reception by authorized recipients without requiring any additional bandwidth as the number of points of reception increases.

LTE, P25 data channels and other networks can be used to provide a backchannel, creating a two-way capability. Band 14 LTE integration was successfully demonstrated in Harris County, Texas by SpectraRep and Houston Public Media in February 2016 as part of a DHS-funded pilot.

Datacasting today works by encapsulating IP data into the digital television MPEG transport stream. The FCC-approved A/90 data broadcast standard allows for ancillary data transmissions. The new broadcast standard, in place by the FirstNet rollout, is natively IP and will provide additional benefits.

Unlike most networks that can become congested when demand exceeds capacity, datacasting provides a constant bit rate, in good times and in bad. More importantly, MOUs can be established to allow for an increase in bandwidth when needed most during emergencies. This ability to increase bandwidth to support additional concurrent encrypted program streams, combined with the native multicast nature of TV broadcasts, allows for significantly more video and data to be shared by multiple agencies without concern about bandwidth congestion.

Broadcast Infrastructure Resiliency

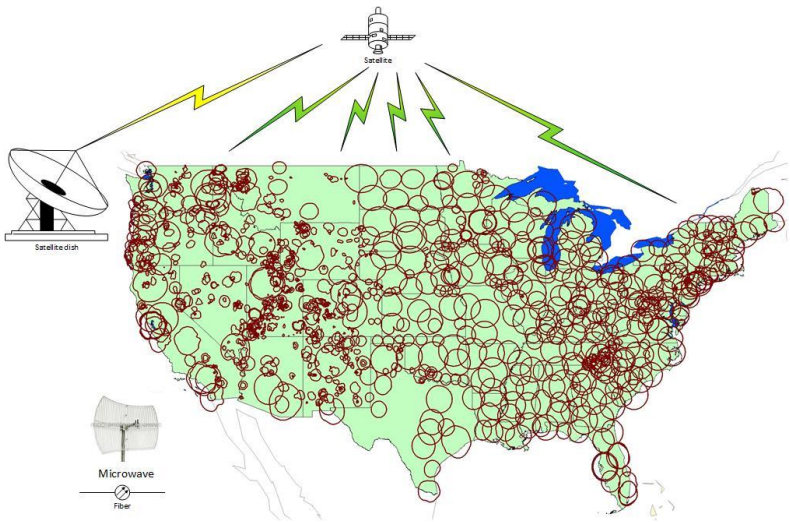
Public television stations have many decades of experience hardening their infrastructure against local weather and other possible hardship conditions. Generators, redundant systems, equipment upgrades, and 24/7 oversight by professional engineers is the standard.

With very rare exceptions, broadcast television has continued to operate during disasters, severe weather and extended power outages. For example, during Superstorm Sandy, New Jersey Public Television continued to operate on generator power for seventeen days. This maintenance of effort was possible because of the large fuel tanks and priority fuel delivery in place to support emergency alerting. Some stations have upgraded to natural gas generators giving them virtually unlimited runtime.

Security is also a priority for broadcast facilities. Card access, locked doors, security personnel and other measures are in place to protect their core assets. All of this infrastructure, in place to support broadcast operations, is also beneficial to public safety users when they use this network.

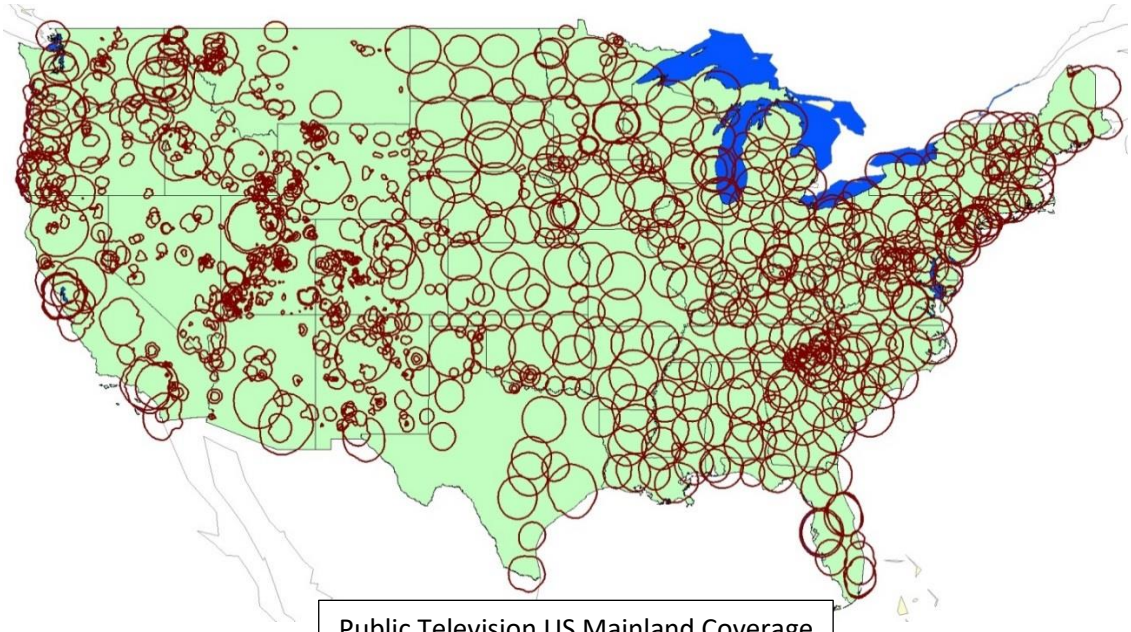
Broadcast Infrastructure – More than just Spectrum

Clearly, the licensed spectrum allocated to public television has tremendous value and is the heart of the datacasting service. Public broadcasters have also invested heavily in content backhaul, satellite, fiber, portable uplinks, vertical real estate and other assets. Public television also has extensive expertise and experience in moving high value content locally, regionally and even nationally. Deploying existing assets quickly to move content and solve content ingest problems is the nature of the broadcasting business and part of the stations' daily operations.



Coverage

Public Television covers 97% of the US population, including territories, right now. This coverage has been enhanced over several decades. Lower power gap filler transmitters and other improvements have been optimized to improve coverage in support of the core broadcasting business model.



Public Television US Mainland Coverage

Rural coverage has been optimized in order to deliver educational and informational content to every citizen. This extensive coverage has been underwritten by federal, state, and local funding, allowing public safety to benefit from that existing investment.

Examples and Use Cases

Clark County School District (CCSD), School Safety Program

Initiated in 2008, the Clark County School District (Las Vegas) secured funding to improve their ability to deal with an active shooter incident. This current, operational system managed by Vegas PBS uses SpectraRep technology transmit building floor plans, evacuation plans, school and medical records, lists of hazardous materials, live video feeds from schools to first responders and other data. The IP data is delivered over the Vegas PBS digital television signal, which is powerful enough to reach first responders anywhere in the county, including distant rural areas. In May 2010, SpectraRep's IncidentOne deployment in Clark County received the International Association of Chiefs of Police's *2010 Excellence in Technology Award.*

Virginia Tidewater University Safety Project

In 2010, working with the Virginia Tidewater Consortium for Higher Education, public television station WHRO-TV and SpectraRep constructed a system to improve school security on college campuses including William and Mary, Old Dominion, Regent, Hampton, Norfolk State, Tidewater Community College, Virginia Wesleyan, Christopher Newport and others.

U.S. Park Police on the National Mall Project[1]

The US Park Police in Washington, DC have been working with public television station WHUT-TV and SpectraRep for many years to distribute helicopter and other video during large crowd events.

Massachusetts Emergency Management Agency Project

After the Boston Marathon bombing, it was clear that access to live helicopter video needed to be improved. A datacast partnership between public television station WGBH-TV and SpectraRep is now in place and used by Massachusetts Emergency Management Agency (MEMA) to address this and other information sharing issues.

DHS Funded Projects in Houston and Chicago

During DHS sponsored tests, monitored by the JHU/APL,[2] software created by SpectraRep was installed on a Sonim band 14 phone, which was then ingested by the datacasting dashboard and from there was datacast to multiple remote recipients. While datacasting over digital television is natively one-way, SpectraRep and public television stations have already demonstrated band 14 LTE integration to create a two-way capability. This capability is currently being used by the Houston Police Department and Houston Fire Department over the band 14 system in Harris County, Texas, in collaboration with Houston Public Media.

Houston PD used this capability with Houston Public Media during the Republican Presidential Debate in February 2016. Datacasting provided three capabilities to enhance security at that event that would not have been available otherwise:

1. Datacasting was used to deliver video surveillance from cameras on the University of Houston campus to the Houston PD and Houston Fire command vehicles at the scene. University of Houston Office of Emergency Management personnel also viewed surveillance video, including HPD helicopter feeds, pushed by Houston PD using datacasting technology.
2. Video surveillance was also accessed using the SpectraRep datacasting dashboard over an Internet connection. Houston PD and University of Houston were both contributing video to the datacasting dashboard. Some users, including both command centers, accessed the other agency's video solely from that dashboard rather than over-the-air. SpectraRep was informed that both HPD and University of Houston OEM would not have had access to the other organization's video without this.
3. Houston Fire also tested the new LTE integration to feed live video to the datacasting system from LTE devices. HFD originated video from an LTE cell phone, which was viewed at the OEM command center and then pushed out over the KUHT television signal to the HFD command vehicle at the scene of the debate on the University of Houston campus.

Harris County also hosted an exercise to evaluate datacasting as a way to distribute video and other situational awareness data through Houston Public Media[3] during a simulated incident. The City of Houston, NRG Park, the University of Houston OEM, KUHT, Harris County Public Safety Technology Services, Houston Police Department, University of Houston PD and OEM, and the Harris County

[1]US Park Police Datacasting Video http://www.youtube.com/watch?v=sOMaGKJGGYI
[2]JHU/APL Houston Report
http://www.firstresponder.gov/TechnologyDocuments/Houston%20Datacasting%20Pilot%20After%20Action%20Report.pdf
[3]KUHT Datacasting Video https://youtu.be/tsJfiJQggYQ

Sheriff's Office all participated in this exercise. This event won the top honor at a recent Secured Cities conference. It was the first time judging for the top award was unanimous.[4]

Harris County will use datacasting again for multi-agency coordination during the NCAA Men's Basketball Championship Final Four in April 2016 and Super Bowl in January 2017. They are in the process of designing datacasting into day-to-day operations, including systematizing access to blueprints and LTE video from fire scenes for the Houston Fire Department. In collaboration with Houston Public Media datacasting is operational now in Houston. The Police and Fire Departments have incorporated datacasting into their communications plan with the Harris County band 14 system that serves as a FirstNet testbed.

DHS, JHU/APL and SpectraRep also collaborated for tests with the Chicago Police Department and Chicago Fire Department using the WTTW public television transmitter on top of the Willis Building in downtown Chicago[5].

Other Applications

Recent conversations with public television stations have yielded several examples where the benefit of partnering with public television goes above and beyond the spectrum and broadcast assets.

- **Helicopter Video** - SpectraRep and Maryland Public Television, are in discussion with the Maryland State Police to provide a statewide network that will provide helicopter video to the State Police and others throughout the state. We will use MPT tower and fiber assets to improve air-to-ground transmission as part of the complete solution.
- **Disaster Area Coverage** – Fire and weather ravaged areas are a special challenge for public safety agencies. Television has a long history of providing service to these areas.
- **Backup Operations Centers** – Public television station facilities including banks of telephones, large operations rooms, high speed Internet, satellite uplink and other infrastructure have been used as backup operations centers when primary facilities are compromised.
- **Existing Connectivity to Public Safety Infrastructure** – In many areas public television is already connected to public safety networks, and serves as a relay point. Leveraging existing towers, fiber, satellite and other infrastructure makes public television a great partner.
- **Marine** – Public television coverage over water exceeds that of cellular. The U.S. Coast Guard, has tested out to sea off the coast of Boston and in the middle of Lake Michigan off the coast of Chicago. Improving security at the Port of Long Beach and other marine applications are also being explored.

Summary

Datacasting over public television complements FirstNet by offering additional licensed spectrum that is already built-out and operating, is natively multicast and serves rural communities now.

APTS and SpectraRep have demonstrated the benefits of integrating datacasting and LTE to enhance public safety communications. Merging these technologies and capabilities improves performance, speeds deployment and reduces costs.

[4] Secured Cities Article http://securitytechnologyexecutive.epubxp.com/i/618378-nov-dec-2016 (pages 16-20)
[5] JHU/APL Chicago Report
http://www.firstresponder.gov/TechnologyDocuments/Chicago%20Datacasting%20Pilot%20After%20Action%20Report.pdf

Datacasting is:

Reliable – Broadcast television has an 80 year history of reliability, even during severe weather and extended power outages

Ubiquitous – Public television reaches 97% of the US population today.

New Licensed Spectrum – Licensed spectrum is the key to consistent reliable service. Broadcast television operates on licensed spectrum with unique capabilities.

Multicast – Datacasting can deliver encrypted video, files, alerts or other data to an unlimited number of public safety users. Datacast is send-once, receive-many just like the TV signals it rides on.

Secure – All data distributed over datacasting is encrypted with at least the public safety AES-256 standard. Even higher levels of encryption can be used when needed.

Targetable – Unlike traditional TV content, datacasting can target content to specific users or groups of users. Content owners can be assured that only recipients they authorize will receive what they send.

Scalable – A constant minimum of 1Mbps allows an unlimited number of users to view multiple video streams and receive files. This minimum can be increased during emergencies to provide access to even more discrete content streams.

Non-congestible – Datacasting is not subject to congestion during emergencies. The licensed television spectrum is controlled by the TV station licensee. When they allocate bandwidth to public safety, the same quality of service will always be available.

Full-time – Datacasting provides an always on full-time capability for public safety.

Datacasting through the public television infrastructure will allow FirstNet to provide improved public safety communications more rapidly and inexpensively[6]. It will provide redundancy and can be used to off-load video and large files to reduce LTE congestion and expand service during emergencies[7].

Public television stations and SpectraRep have substantial and reliable nationwide infrastructure, proven technology and decades of relevant experience to help FirstNet accomplish its objectives more quickly and economically. We stand ready to work with FirstNet and its prime contractor in offering this creative, cost effective information sharing service to better serve our communities, public safety and homeland security.

[6]DHS Datacasting Factsheet
http://npstc.org/download.jsp?tableId=37&column=217&id=3583&file=Datacasting_Fact_Sheet_150810.pdf&utm_source=Video+Datacasting%3A++New+100+Second+Video&utm_campaign=IWCE&utm_medium=email

[7] DHS Video – Datacasting in 100 seconds
https://www.youtube.com/watch?v=NeJ81_RtBhY&feature=player_embedded